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The Interaction Sequence Graph records the occurrence of events according to Flanders' 10 categories of verbal interaction, the duration of each behavioral event, and the relationship of each event to those which precede and follow it. Data obtained by observing classroom teaching are analyzed and converted from a long series of numbers to a series graph. The sequence graph consists of a series graph in which the series are joined according to specified behavioral pattern conventions and placed on a horizontal line indicating time at three-second intervals. A graph summary, presenting the information contained in the graph in sequence classes (more manageable units consisting of related sequences) is then constructed. However, because this summarization distorts time and sequence relationships, a miscellaneous class and a time duration notation system were devised. Therefore, each interaction sequence graph reflects the teaching patterns of a given teacher for a given classroom period and can be compared (using a representative graph) to similar data for other teachers. (Included are definitions of terms, behavioral descriptions of sequence classes, and a seven-item bibliography.) (See also SP 002 488.) (SM)

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THE INTERACTION SEQUENCE GRAPH:

ANALYZING FOR PATTERNS OF TEACHING BEHAVIOR

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The interaction sequence graph was developed as a method of presenting recorded measurements of whole periods of teaching behavior. The interaction sequence graph preserves the fact of the occurrence of a category of behavior, the duration of the behavioral event, and its relationships to all of the behavioral events which preceded it and which followed it. (Graph number 1 on page 2 shows the general form of the interaction sequence graph.)

The data, obtained by observing classroom teaching, are analyzed for the presence of recurring patterns of teaching behavior.

The interaction sequence graph simultaneously displays all coded behavioral units for any given classroom period. The units of behavior are the ten categories of verbal interaction developed by Flanders.[1] The horizontal axis of the graph is a time line with maximum time divisions of 3 seconds, i.e., the time interval of one graph square.

9 (student initiated talk)
8 (student response to teacher)
3 (teacher response to student ideas)
4 (teacher asking questions)
5 (teacher lecturing)
----------time----------

Category 5, teacher giving information, seems to be the basic pivot point or base line of a teacher's behavior. The next category, 4, is questions asked by the teacher. Category 3 is usually a teacher's response to student talk and, by definition, always refers to expanding student ideas or referring back to previously developed ideas. Category 8, student response to the teacher, is placed as close to Categories 4 and 3 as possible to show the flow between asking a question, receiving an answer, and developing or accepting the student's answer. Category 9, student initiated response, is placed at the upper extreme of the graph and represents the greatest freedom from the teacher's influence as the student breaks into the interaction pattern or is encouraged to develop and expand his own ideas rather than following the guidelines laid out by the teacher.

The remaining four categories of teacher talk are interspersed in the spaces within the upper and lower limits of the graph. Category 10 (or 0), silence or confusion, may be placed on any line or space. The primary concern is to show the flow of interaction in such a way that any existing patterns may become apparent.

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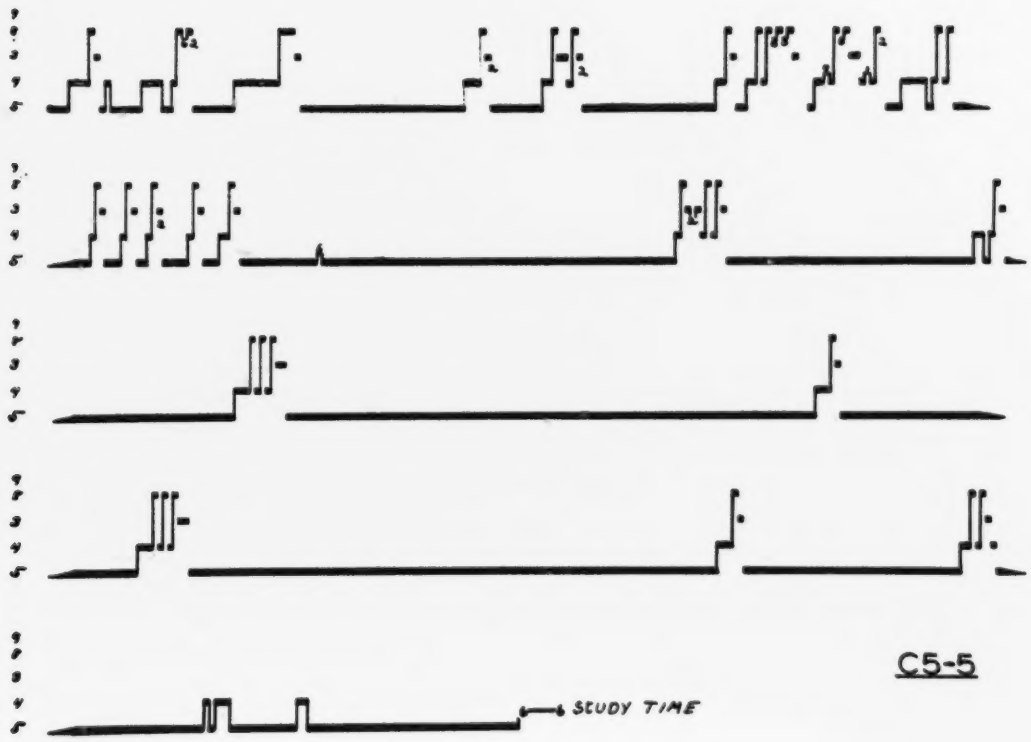
[1]Ned A. Flanders, Teacher Influence: Pupil Attitudes and Achievement, (Minneapolis: Cooperative Research Project 297, University of Minnesota, 1960).

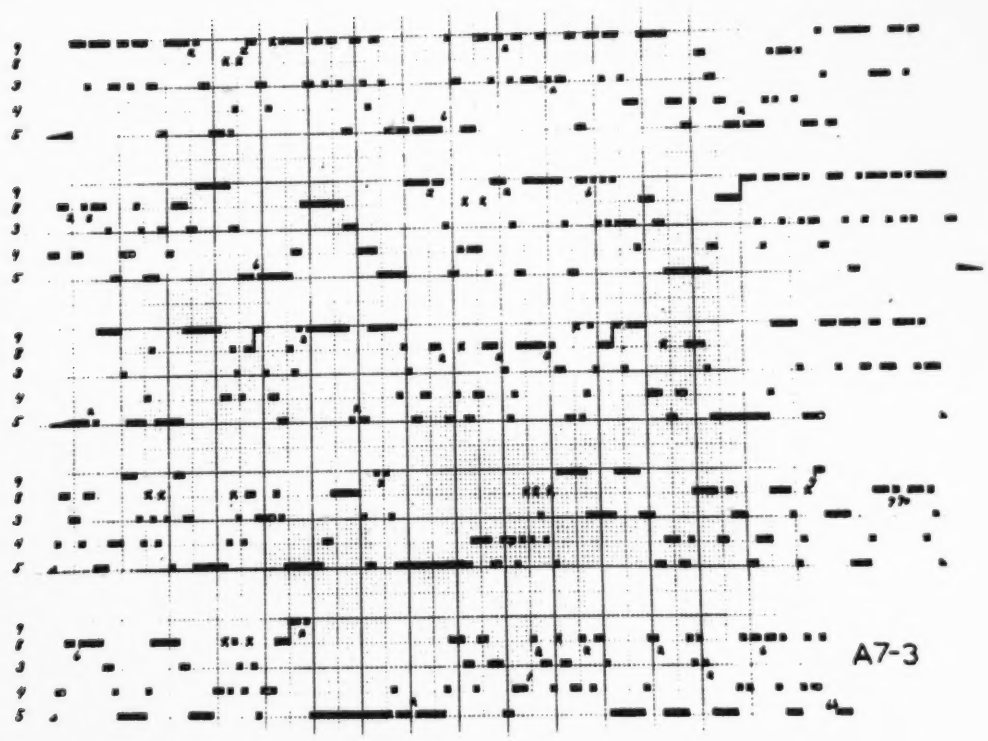
GRAPH 1

The Interaction Sequence Graph



GRAPH 2

The Interaction Series Graph



Primary Data Processing: The Interaction Series Graph

The first step in processing the raw data, which was in the form of a long series of numbers, 1 through 10, was to convert the data into a series graph. A series of 12 conventions have been developed for constructing the series graph. (Graph number 2 on page 2 is an example of the interaction series graph.)

Secondary Data Processing: The Interaction Sequence Graph

Once the series graph is completed, the sequence graph can be constructed. The sequence graph consists of a series graph in which series might be joined by vertical lines according to the following conventions.

1. Vertical lines are drawn between series following one another in time sequence until an 8 or 9 series is connected with the preceding teacher talk series.

2. Whenever a Category 3 series follows a student response series, it is not connected to preceding teacher talk series. It will not be connected to any following series unless that series is one of student talk.

3. Usually most vertical lines will rise from the base of the graph, and all vertical lines will terminate with a student talk series. The usual origin of many sequences will be either a Category 4 series or a Category 5 series.

4. Vertical lines will fall only when the new sequence begins with a Category 4 series or when the teacher talk series alternate without involving a student talk series.

5. A short vertical line will be used to indicate when a new student begins talking directly after another student finishes and there is no teacher talk category intervening.

Tertiary Data Processing: Patterns

The problem of analyzing patterns of teaching was finding a method of identifying and classifying series and sequences of behavior into "manageable parts which can then be understood individually in their relations to the flow."[2] The following operational definitions were established to aid in classifying "manageable parts."

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[2]Gale W. Rose, "Performance Evaluation and Growth in Teaching," Phi Delta Kappan 45:48, October, 1963.

Series: A succession of behavioral events in one and only one verbal behavior category.

Sequence: The succession of series which occur between the end of one student talk series and the end of the next student talk series.

System: Any identifiable assemblage of behavioral events united by some form of regular interaction or interdependence; any established relation of a customary mode of instruction.

Pattern: "An identifiable grouping of behaviors which occur in the same teacher."[3]

A system may be identified in terms of series characteristics, sequence characteristics, combinations of series and sequences, and a number of other more common descriptive techniques such as frequencies, matrices of categories, or other units of behavior. All of these modes of description may be relevant and useful to describe the behavioral characteristics of a teacher and to compare those characteristics to those of another teacher.

The definition of a pattern of teaching behavior is viewed as including the term, system, as previously defined. Patterns of teaching behavior were reported in terms of system characteristics by the use of narrative.

Determination of Recurring Patterns of Teaching

The simplest and fastest index to a teacher's pattern of teaching behavior is the compilation of similar sequences. The frequency of recurrence of each sequence can then be determined for each period of teaching. This compilation, called a graph summary, represents a pooling of data from the sequence graph in order to obtain more manageable units called sequence classes.

The sequence class is a grouping of related sequences. This pooling ignores both the time duration of any given sequence and the relationships between sequences. In order to compensate partially for this distortion and loss of relationships between all behavioral events occurring within a sequence, a miscellaneous class was developed. The miscellaneous class included such

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[3]Norman E. Wallen and Robert M. W. Travers, "Analysis and Investigation of Teaching Methods," Handbook of Research on Teaching (Chicago: N. L. Gage, Ed., Rand McNally and Company, 1963), p. 451.

behavioral events as extended student responses, the teacher's extended development of student responses, the teacher's referral to student ideas within the course of a lecture.

The time duration for subdivided sequence classes was designated as short (S), medium (M), long (L), and extended (X). Table 1 indicates the range of time associated with each notation.

TABLE 1

TIME DURATION NOTATIONS

Series	S	M	L	X
5	3-9 sec.	12-27 sec.	30-57 sec.	1 min. or more
3	3-6 sec.	9-15 sec.	18-27 sec.	30 sec. or more
8 or 9	Any student talk of 9 sec. or more was considered as extended in the original study.			

The time interval of Category 4 series was not studied as the data recording technique did not distinguish between a single question which took a long interval of time to ask and a long series of short questions which did not result in a student response. There were also apparent differences in the kinds of questions asked which, although beyond the scope of the study, appeared to be a better basis of subdividing the questions asked by the teacher.

The identification of 10 sequence classes and their subdivisions is shown in Table 2.

TABLE 2

SEQUENCE CLASSES

Class	Subdivision
5 - 8	S M L X
5-4-8	S M L X
4-8	None
3-8	S M L X
n-8	None
5 - 9	S M L X
5-4-9	S M L X
4-9	None
3-9	S M L X
n-9	None

The description of each sequence class in terms of the behavioral events or instructional techniques it represents is shown in Table 3.

TABLE 3

BEHAVIORAL DESCRIPTIONS OF SEQUENCE CLASSES

5 - 8	The teacher presented information to which a student responded. The student response was limited to the ideas just presented by the teacher.
5-4-8	The teacher presented new information and followed up by asking a question to which a student responded routinely.
4-8	The teacher asked a question to which a student responded routinely.
3-8	The teacher developed the ideas of a previous student response. Another student response was made. This response was limited to the ideas developed by the teacher.
n-8	A student responded in a way which was conditioned by the teacher's use of Categories 1, 2, 6, 7, 10, or by the teacher's calling for or permitting another student response.
5 - 9	The teacher presented new information, and a student was allowed to break into the teacher's presentation by initiating a question as an idea not presented by the teacher.
5-4-9	The teacher presented new information and followed up by asking a question. Several variations of student responses were represented by this sequence depending on the kind of question asked. It may represent a student query about the question, a student response to an open-ended question, or an unexpected student response to a directive question.
4-9	The teacher asked a question to which a student responded. Several variations of student responses were represented by this sequence depending on the kind of question asked. It may represent a student query about the question, a student response to an open-ended question, or an unexpected student response to a directive question.
3-9	The teacher developed the ideas of a previous student response. Another student response occurred which was either concerned with the idea originally presented or the initiation of another new idea. This sequence often represented give and take between a teacher and the students in which the teacher limited his comments to the ideas of the

student. The borderline between Categories 3 and 5 was often difficult to determine.

n-9 A student initiated a response following the teacher's use of Categories 1, 2, 6, 7, 10, or following the teacher's indication of who was to speak next. Student to student interaction may be represented by a series of these sequences.

In order to illustrate the graphical technique, the use of the graph summary, and the interpretive value of the sequence graph, three entirely different records were selected. The graphs are arranged in a simple to complex order of verbal instructional patterns.

Summary

Each interaction sequence graph reflects the teaching patterns of a given teacher for a given classroom period. When combined with enough records, it is possible to derive a generalized description. A representative graph, one which has the least deviation from all records of behavior, can be selected as a best fit which can then be compared to similar data for other teachers.

The contribution of this study to methodology of analysis of teaching behavior was presented in terms of the interaction sequence graph and the sequence classification system. Perhaps the sequence graph comes the closest to preserving the "organic whole" of the teacher-pupil interaction process. A number of manipulations were discussed which might prove useful in assessing the characteristics of a "system" which can be used to determine the presence of recurring patterns in a given teacher's classroom behavior.

GRAPH 11

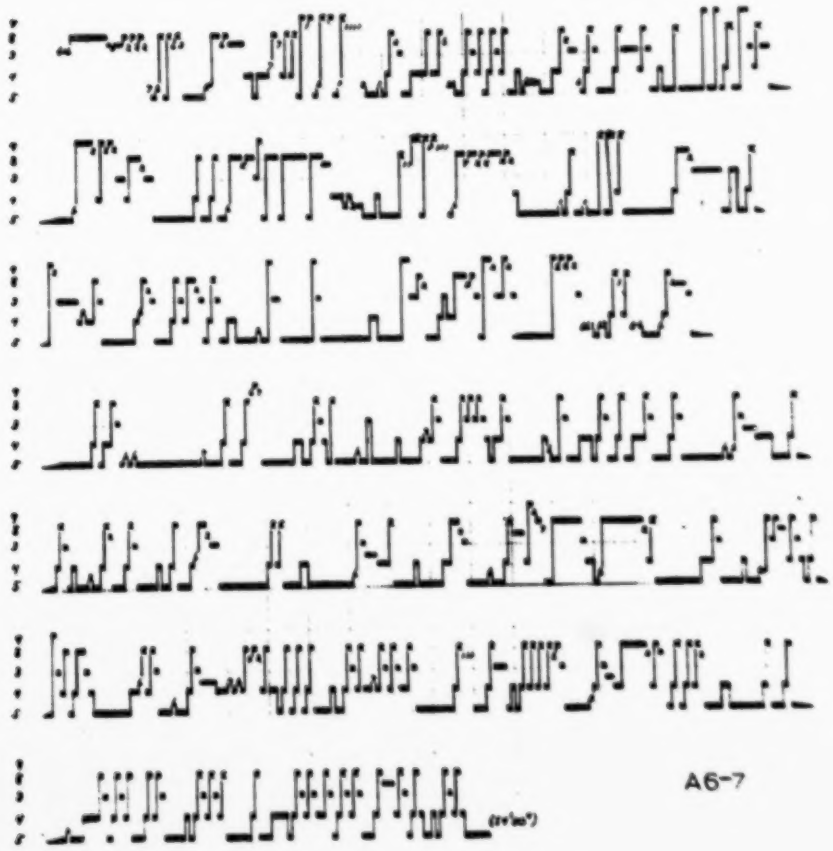

TABLE 11
SUMMARY OF GRAPH 11

Class	Occur-rences	Sequence duration S	M	L	X	Miscellaneous Class	Occur-rences
5 - 8	14	8	4	2		Ext. 3	4
5-4-8	68	39	19	11	1	Ext. 8	5
4-8	38					Ext. 9	1
3-8	4	4				5-3-5	2
n-8	13					4-3-4	1
5 - 9	17	10	6	1			
5-4-9	-						
4-9	3					Total misc.:	13
3-9	2	2				Time span:	53 min.
n-9	7					Total sequences:	172

GRAPH 16

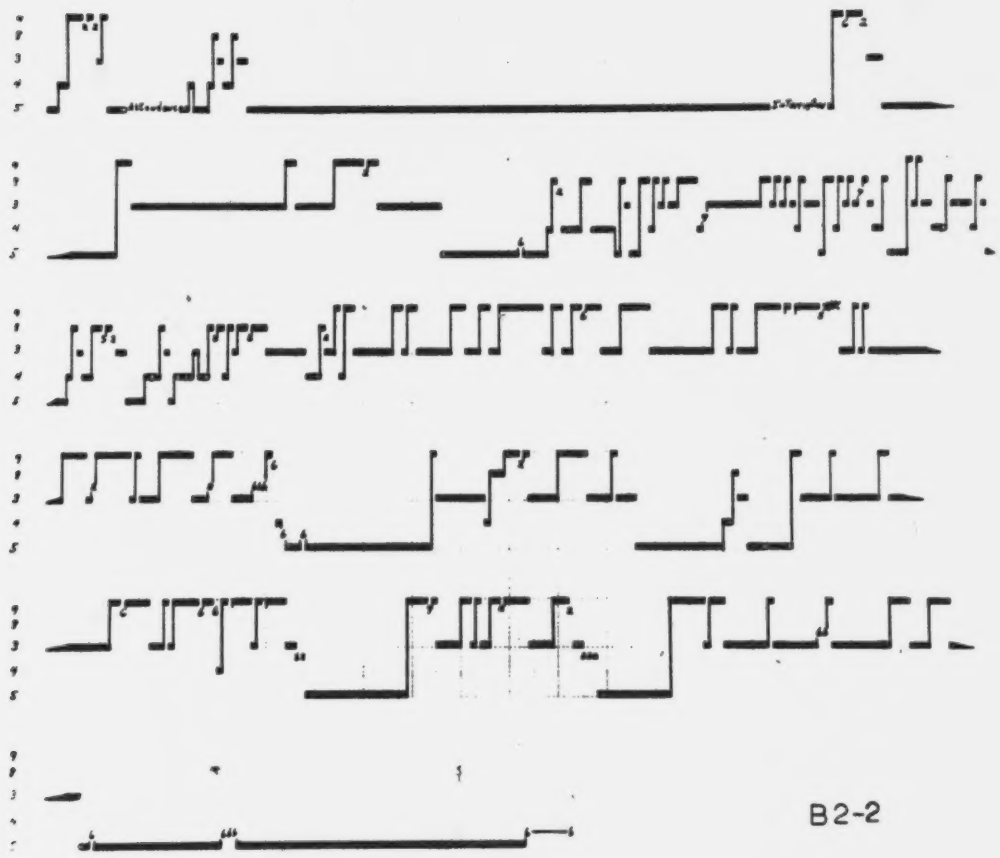

TABLE 16
SUMMARY OF GRAPH 16

Class	Occur-rences	Sequence duration S	M	L	X	Miscellaneous Class	Occur-rences
5 - 8	4	4				Ext. 3	8
5-4-8	7	3	2	1	1	Ext. 8	1
4-8	14					Ext. 9	17
3-8	7	7				5-4-3-4	1
n-8	3					4-3-(8)	1
5 - 9	7		2	1	4		
5-4-9	1	1					
4-9	-					Total misc.:	28
3-9	40	15	12	9	4	Time span:	50 min.
n-9	14					Total sequences:	97

GRAPH 32

TABLE 32
SUMMARY OF GRAPH 32

Class	Occur-rences	Sequence duration S	M	L	X	Miscellaneous Class	Occur-rences
5 - 8	-					Ext. 3	-
5-4-8	23	7	8	1	7	Ext. 8	-
4-8	13					Ext. 9	-
3-8	1	1				4-3-4	1
n-8	1					4-3-5	1
5 - 9	-						
5-4-9	-						
4-9	-					Total misc.:	2
3-9	-					Time span:	43 min.
n-9	-					Total sequences:	38

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